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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/628,188	07/28/2003	George J. Fechko JR.	5000.302	6095

21176 7590 05/02/2006

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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1722	

DATE MAILED: 05/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/628,188	FECHKO ET AL.	
	Examiner	Art Unit	
	Matthew J. Song	1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 February 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6-13,15-25 and 27-31* is/are pending in the application.

4a) Of the above claim(s) *9-10, 20, and 30-31* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4,6-8,11-13,15-19,21-25 and 27-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 1-4, 6-7, 11-13, 15-17, 21-25, and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carter (US 2001/0019132 A1) in view of Otani et al (JP 08-208380), an English abstract and Computer translation (CT) have been provided.

In a method of forming silicon carbide, note entire reference, Carter discloses a method of forming bulk silicon carbide by heating a silicon carbide source powder to sublimation in a growth chamber, heating and then maintaining a silicon carbide seed crystal in the growth chamber to a temperature, which sublimed species will condense on the seed crystal, continuing to heat the silicon carbide source until a desired amount of silicon carbide has occurred on the

seed crystal ([0015]). Carter teaches a seed crystal and the source was kept between 2100-2500°C with the seed being 300-350°C lower ([0031] and [0038]). Overlapping ranges are held to be obvious (MPEP 2144.05).

Carter et al does not disclose introducing an ambient gas containing hydrogen into a sublimation chamber.

In a method of producing silicon crystalline silicon carbide, note entire reference, Otani et al teaches a gaseous hydrogen is incorporated into inert gas such as Ar and the resultant gas is used as atmospheric gas for a silicon carbide single crystal grown by a sublimation-recrystallization method (Abstract). Otani et al also teaches using hydrogen and argon as a controlled atmosphere to control diffusion of molecular species, which contribute to growth, and allows for production conditions of ideal stoichiometry silicon carbide monocrystal with few defects (CT [0006]-[0009]), this reads on applicant's reducing nitrogen incorporated into the growing crystal by controlling the hydrogen concentration of the ambient atmosphere because nitrogen incorporation would have the SiC to deviate from ideal stochiometry. Otani et al also teaches carrying out pressure control and the maintaining the internal pressure at about 600-10 Torr (CT [0011]-[0012]). Otani et al teaches 1 ppm-90% hydrogen gas as a controlled atmosphere (CT [0008]) and specifically 1% hydrogen for a pressure of 600-10 Torr (CT [0012]).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Carter by using a hydrogen atmosphere, as taught by Otani et al, to form a silicon carbide single crystal with few defects and ideal stoichiometry.

Referring to claim to claim 2, the combination of Carter and Otani et al teaches a internal pressure of 600-10 Torr (CT [0012]). Overlapping ranges are held to be obvious (MPEP 2144.05). Furrthermore, pressure is a well known result effective variable; therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Carter and Otani et al by optimizing the pressure to obtain the claimed range by conducting routine experimentation of a result effective variable (MPEP 2144.05).

Referring to claim 3, the combination of Carter and Otani et al does not teach the claimed flow rate, however it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Carter and Otani et al by using the claimed flow rate to obtain a desired concentration of hydrogen in the ambient atmosphere.

Referring to claim 6-7, the combination of Carter and Otani et al teaches a nitrogen concentration of $5x10^{16}$ cm^{-3} or less. Overlapping ranges are held to be obvious (MPEP 2144.05) and the combination of Carter and Otani et al teaches a similar method sublimation using a hydrogen ambient; therefore the claimed nitrogen concentration is inherent to the combination of Carter and Otani et al because a similar method is expected to produce a similar product.

Referring to claim 11, the combination of Carter and Otani et al does not teach the maintaining an ambient concentration of hydrogen in the growth chamber sufficient to passivate the growing silicon carbide. However, this limitation is inherent since the combination of Carter and Otani et al teaches an overlapping range of hydrogen, specifically 1% hydrogen for a pressure of 600-10 Torr (CT [0012]), as taught by applicant, note instant claim 12; therefore a similar amount of hydrogen is expected to produce similar results.

3. Claims 8 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carter (US 2001/0019132 A1) in view of Otani et al (JP 08-208380), an English abstract and Computer translation (CT) have been provided, as applied to claims 1-4, 6-7, 11-13, 15-17, 21-25, and 27-29 above, and further in view of Maeda (JP 06-128094), an English Abstract and Computer translation (CT2) have been provided.

The combination of Carter and Otani et al teach all of the limitations of claim 8, as discussed previously, except introducing a hydrocarbon species into the growth chamber to establish the hydrogen ambient.

In a method of producing silicon carbide single crystals, note entire reference, Maeda teaches introducing a carbon component gas such as propane, this reads on applicant's hydrocarbon. Maeda teaches the introduction of propane cancels out the variation in the sublimated gas composition generated from the silicon carbide raw material into a crystal growth zone. Maeda also teaches a stoichiometrically pure and high quality product can be produced (Abstract).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Carter and Otani et al by using a hydrocarbon gas, as taught by Maeda, to produce a stoichiometrically pure and high quality product.

4. Claims 8, 11-13, 15-18, 21-25 and 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carter (US 2001/0019132 A1) in view of Otani et al (JP 08-208380), an English abstract and Computer translation (CT) have been provided, and Maeda (JP 06-128094),

an English Abstract and Computer translation (CT2) have been provided, as applied to claims 8 and 18 above, and further in view of Barrett et al (US 5,611,955).

The combination of Carter, Otani et al and Maeda teach all of the limitations of claim 11, as discussed previously, except maintaining an ambient concentration of hydrogen in the growth chamber sufficient to passivate the growing silicon carbide crystal. The Examiner maintains the feature would be inherent to the combination of Carter and Otani, however the Examiner's inherency position is further evidenced by Barrett et al.

In a method of forming silicon carbide single crystals, note entire reference, Barrett et al teaches a silicon carbide single crystal grown by sublimation. Barrett et al teaches non-metallic impurities such as hydrogen may serve as passivating traps for shallow residual impurities (col 2, ln 35 to col 3, ln 55).

The combination of Carter, Otani et al, and Maeda does not teach passivating with hydrogen, however this feature would be inherent because the combination of Carter, Otani et al, and Maeda teaches a similar method of sublimation in a hydrogen ambient within an overlapping ranges, as applicants; therefore passivation is inherent because a similar method is expected to produce a similar and passivation is evidenced by Barrett et al, which teaches a hydrogen ambient can be used to passivate a silicon carbide single crystal.

Response to Arguments

5. Applicant's arguments filed 2/20/2006 have been fully considered but they are not persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Otani et al is not relied upon to teach the claimed temperature gradient. The temperature gradient is taught by Carter. Otani et al teaches a method of using hydrogen in an atmosphere during sublimation growth of SiC to grow a high quality SiC crystal (CT [0007]-[0009]). Otani et al also teaches heating a raw material and a seed crystal to a desired temperature (CT [0011]). Otani et al does not limit the temperature of the raw material or seed crystal. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the temperatures desired and taught by Carter et al, namely a raw material temperature of 2100-2500°C and a seed temperature 300-350°C below the temperature of the raw material ('132 [0038]). Furthermore, Otani et al inherently must teach a temperature gradient because the sublimation gas would not deposit on the seed crystal unless the seed crystal is maintained at a temperature lower than the sublimation temperature of the gas.

Applicant's argument that Otani et al is irrelevant to the amended claim is noted but is not found persuasive. Otani et al relates to the production of a high quality SiC crystal using a sublimation recrystallization reaction. Applicant's invention relates to the growth of SiC using sublimation; therefore applicant's argument is not found persuasive.

Applicant's argument regarding claims 3, 13 and 25 are noted but are not found persuasive. Applicant's allege that the flow rates cannot be claimed to be inherent, as suggested by the Examiner. However, the Examiner never suggested the flow rates were inherent. Merely that the claimed flow rates would have been obvious to one of ordinary skill in the art through

routine experimentation because hydrogen concentration is taught to be a result effective variable by Otani et al (CT [0009]).

Applicant's argument that Maeda teaches a seed crystal of about 200°C, which is drastically different from the temperature taught by Carter is noted but is not found persuasive. It is noted that the portion of Maeda applicant cites to teach the seed crystal at a temperature of 200°C is merely cited is the "description of prior art" section of Maeda. Maeda is not limited to a seed crystal temperature of 200°C. As taught by Carter, deposition of sublimation gas can occur with a raw material temperature of 2100-2500°C and a seed temperature 300-350°C below the temperature of the raw material.

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1722

MJS
April 24, 2006

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SUPERVISORY PATENT EXAMINER
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